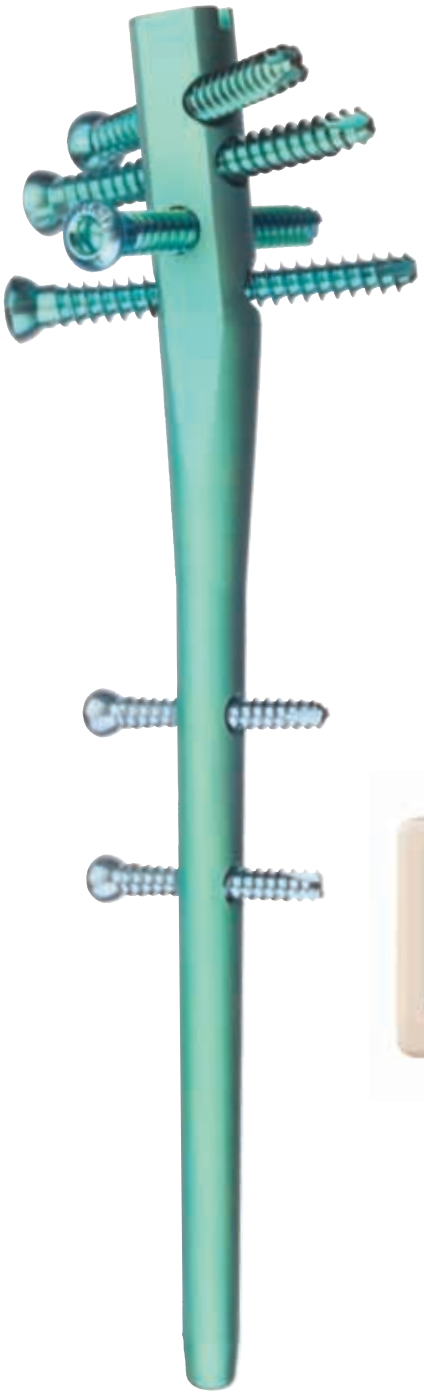
Surgical Technique

smith&nephew

TRIGEN◇
Humeral Nail System

Including

TRIGEN◇ SURESHOT◇
Distal Targeting System



Surgical Technique for the TRIGEN◇ Humeral Nail System using the TRIGEN SURESHOT◇ Distal Targeting System

Table of contents

Introduction 3
TRIGEN Humeral Nail indications 4
TRIGEN SURESHOT indications 5
TRIGEN Humeral Nail design rationale 6
TRIGEN Humeral Nail specifications 7
Warnings and cautions for TRIGEN SURESHOT 8

Surgical Procedure
OR preparation 9

Surgical Technique
Patient positioning 11
Instruments for opening the humerus 12
Incision 13
Entry tool and guide pin placement 14
Instruments fracture reduction and reaming 15
Prepare proximal section 16
Fracture reduction 17
Measuring implant length 18
Additional limited reaming 18
Instruments for nail assembly and insertion 19
Nail Drill Guide assembly 20
Nail insertion 21
Final version adjustment 22
TRIGEN SURESHOT system set up 23
IM Nail assembly drill guide 25
Skin incision with TRIGEN SURESHOT 26
Targeting the locking hole 27
Drilling the distal hole 28
Screw insertion 29
Instruments for proximal locking, distal locking and freehand distal locking of Proximal 16cm Humeral Nails 30
Distal locking screws for TRIGEN Proximal 16cm Humeral Nails 31
Proximal locking screws 32
Distal locking screws without the use of TRIGEN SURESHOT 35
Closure 36

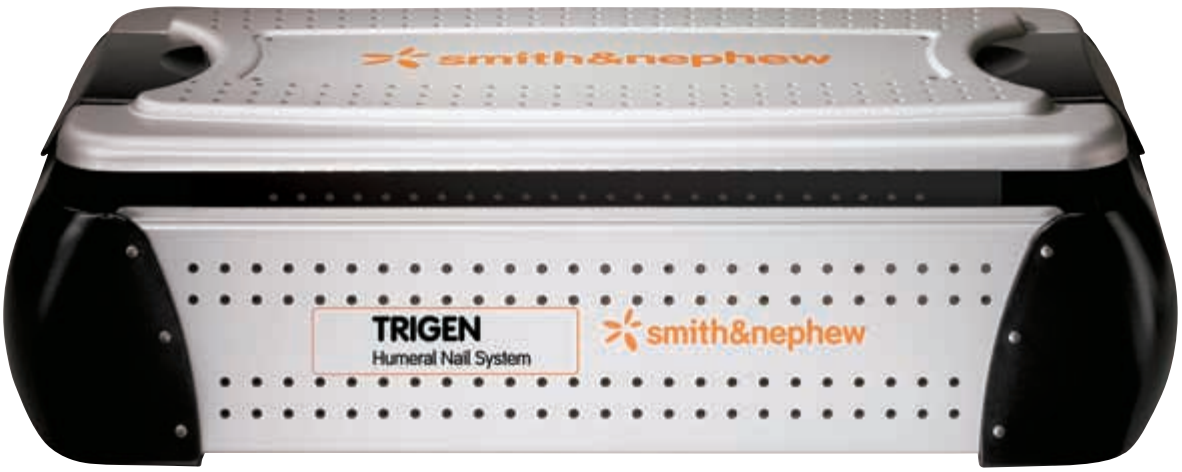
Catalog information 37

Nota Bene
The technique description herein is made available to the healthcare professional to illustrate the authors' suggested treatment for the uncomplicated procedure. In the final analysis, the preferred treatment is that which addresses the needs of the patient.

Introduction

Uncover an easy and advanced nailing system

The TRIGEN® Humeral Nail provides new possibilities for the treatment of proximal humeral fractures and humeral shaft fractures. With multiplanar screws that are threaded into the nail to inhibit proximal screw back-out, and effective, simple instrumentation that helps protect soft tissues, the TRIGEN system now offers an effective intramedullary nail for humeral fracture management.



Introduction
TRIGEN◇ Humeral Nail indications

Two-part fractures of the humerus
Three-part fractures of the humerus
Midshaft Diaphyseal Fracture(s)
Segmental Humerus Fracture(s)

Introduction
TRIGEN® SURESHOT® indications

Legend

Important warnings appear in orange

Tips, tricks and important information appear in blue

Indications, contraindications, intended use and training
The Smith & Nephew TRIGEN SURESHOT Distal Targeting System is intended to be an intraoperative image-guided localization system. It is a computer-assisted orthopaedic surgery tool to aid the surgeon with drill positioning for screws during intramedullary nail implantation. It provides information to the surgeon that is used to place surgical instruments during surgery utilizing intraoperatively obtained electromagnetic tracking data. The Smith & Nephew TRIGEN SURESHOT Targeting System is indicated for long bone fractures treated with intramedullary nails in which the use of stereotactic surgery may be appropriate.

An example of a surgical procedure includes but is not limited to locating and drilling the distal holes in an intramedullary nail.

Contraindications
The screw targeting software application for this system is contraindicated for all IM nails other than Smith & Nephew TRIGEN META-NAIL®, TAN®, FAN, Humeral, Pediatric and Adolescent nails. Do not operate the TRIGEN SURESHOT Targeter within 200mm of an installed pacemaker. The magnetic field produced by the Targeter may interfere with the operation of the pacemaker.

Intended use
The TRIGEN SURESHOT Distal Targeting System is only designed for use with the indicated implants and instruments. Implants and instruments must be used in accordance with the instructions, as described in this manual and/or in the non-navigated surgical procedure.

Training
Only trained operators are allowed to use the TRIGEN SURESHOT Distal Targeting System. The various operating instructions must be fully read and understood as part of the training. If any part of the instructions is unclear, please contact your local Smith & Nephew representative.

Plausibility check
As with all technical equipment, malfunctions may occur due to improper use or, more rarely, technical failure. To reduce the risks involved with such technical malfunction the operation can be completed using manually controlled instruments, providing the malfunction is detected without delay.

It is, therefore, important to check the plausibility of the steps, as indicated by the system, and to carry out verification of the software targeting, particularly when using the system for the first time. Should there be any doubt regarding correct functioning, the targeting should be verified or a switch made to a traditional X-Ray technique.

Refer to the SURESHOT User Manual (7118-1540) for details about the SURESHOT Distal Targeting System.

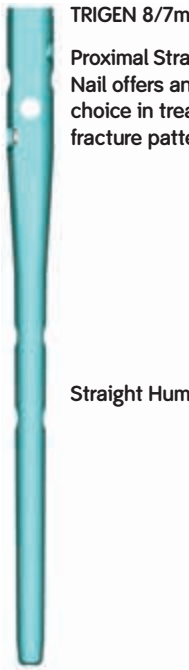
Introduction

TRIGEN® Humeral Nail design rationale

The TRIGEN Humeral Nailing System product offering includes a 16cm Proximal Straight Nail, a 16cm Proximal Bent Nail, and a full line of Long Bent Nails. Nails with a proximal bend are best suited for simple two-part fractures of the proximal humerus involving the surgical neck of the humerus and proximal third humeral fractures without comminution. In these scenarios, the proximal bend facilitates an easier entry portal attainment and nail insertion with an incision just medial to the rotator cuff insertion.

The Long Bent Humeral Nail is primarily indicated for humeral shaft fractures which are inherently not prone to varus malposition. The lateral portal design allows insertion just medial to the rotator cuff insertion and facilitates easier portal attainment and nail insertion.

The 16cm Proximal Straight Humeral Nail offers the option of a medialized entry site. If the greater tuberosity is fractured or compromised, a straight centralized starting point avoids fracture extension from the tuberosity fracture into the entry portal and resultant loss of nail stability. The entry portal for the straight nail is slightly more difficult to attain than the curved nail entry portal.



TRIGEN 8/7mm X 16cm

Proximal Straight Humeral Nail offers an alternate choice in treating different fracture patterns.

Straight Humeral Nail

Four multiplanar proximal locks improve fracture stability.

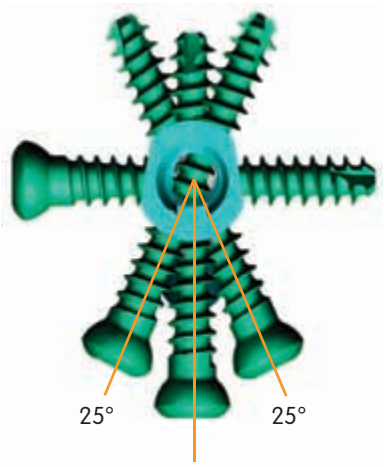
4 degree proximal bend

Long Bent Humeral Nail

Locking holes

5.0mm Cancellous Proximal Locking Screws; 24mm – 64mm lengths, 2mm increments

4.0mm Cortical Distal Locking Screws; 20mm – 40mm lengths, 2mm increments



Proximal locking holes have innovative threaded design. Screws thread into the nail to help prevent screw back-out.

Introduction
TRIGEN® Humeral Nail specifications

TRIGEN

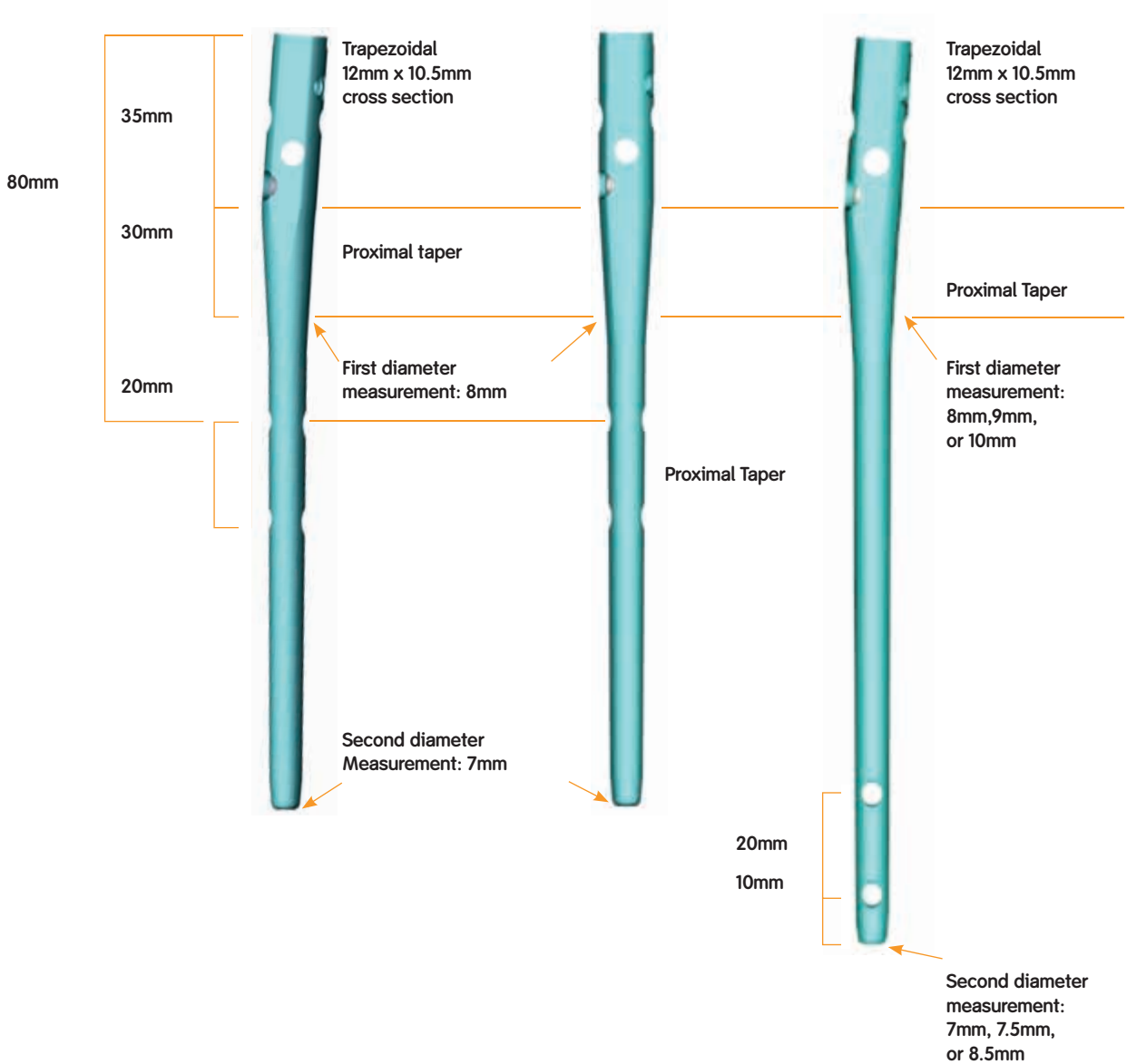
Humeral Nail 8/7mm x 16cm
Proximal Bent Humeral Nail

TRIGEN

Humeral Nail 8/7mm x 16cm
Proximal Straight Humeral Nail

TRIGEN

Long Bent Humeral Nail 8/7mm, 9/7.5mm, 10/8.5mm Diameter; 18cm – 28cm lengths, by 2cm increments



Warnings and cautions for TRIGEN® SURESHOT®

Refer to the SURESHOT® Manual (7118-1540) for all warnings, cautions, maintenance, cleaning and sterilization instructions.

Devices for system set up

Trauma Interface
Cat. No. 7169-2802

Power Cord
Cat. No. 6680-0193

TRIGEN® SURESHOT® Targeter
Cat. No. 7169-2801

Note The Targeter will be operated within the sterile field and may have contact with the skin of the patient. The drill sleeve inserts will be used in the incision and have direct bone contact.

Note Verify that the Targeter housing is not damaged (holes, tears, cracks). If the housing or the connector is damaged, the Targeter is no longer safe to use.

Note If the Targeter is not recognized after connection to the system, the Targeter is defective and must be exchanged. (See also instrument connection).

Note Broken or damaged instruments must be exchanged immediately and sent back to Smith & Nephew, Inc.

Note This device is provided non-sterile and must be cleaned and sterilized per Cleaning and Sterilization (Smith & Nephew document 7138-1339) prior to use.

WARNING: The maximum temperature of the Targeter body can reach 47° Celsius at ambient room temperatures above 30° C. The Targeter body should not remain in constant contact with a patient's exposed skin for more than one minute.

Surgical procedure – OR preparation

Trauma Interface setup

After the sterile areas have been established, place the Trauma Interface (7169-2802) in the desired non-sterile location and turn on the power switch.

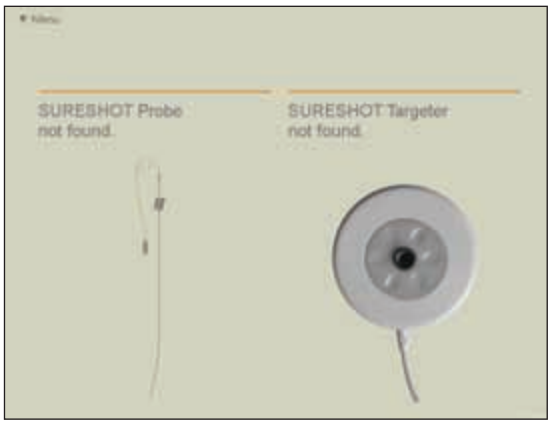
CAUTION: No other electrical devices should be placed near the Trauma Interface. See the "Guidance and Manufacturer's Declaration – Separation Distances" table at the end of this document.

Note If the Trauma Interface does not power on, make sure the switch is in the "on" position.

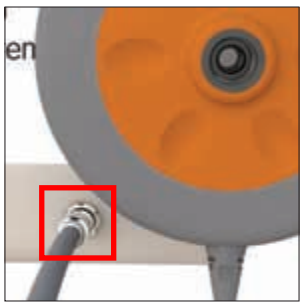
Note The means for mains disconnection of power to the Trauma Interface is the appliance inlet located below the power switch. The Trauma Interface should not be positioned such that it is difficult to reach this location.

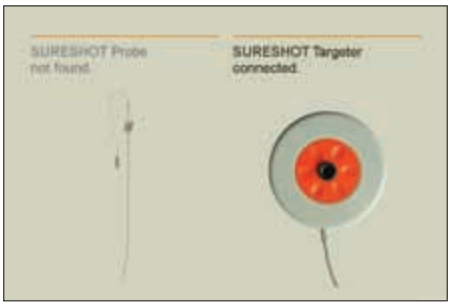
TRIGEN® SURESHOT® Targeter connection

When the display prompts for tool connections, connect the TRIGEN SURESHOT Targeter (7169-2801) to the Targeter port on the Trauma Interface.



Surgical procedure – OR preparation





The SURESHOT® Targeter will change color to orange upon successful connection to the Trauma Interface.

CAUTION: The Targeter body may have contact with the patient and must remain in the sterile field at all times. Only the cable and connector may be removed from the sterile field.

CAUTION: Connect the Targeter at least 10 minutes prior to targeting in order to ensure proper accuracy.

Note When oriented as shown, the connector should assemble easily. Do not force the connector into the port.

Note If the Targeter is properly connected to the system and the application remains in this screen for more than 30 seconds, the Targeter may have been damaged during cleaning/sterilization. In this case another Targeter has to be used.

Note It is possible at any time to disconnect and reconnect tools when the application is running. The display will show a screen reporting the missing instrument.

Surgical Technique
Patient positioning

Supine position
Position the patient supine with three liter bags of saline between scapulas. Tilt the patient on the fluoroimage table so that the humerus may be extended posteriorly.

The C-arm may be positioned either superior to the shoulder or opposite the shoulder if the C-arm modus is large enough.

Alternative position
Position the patient in a slight “beach-chair” position. The arm of the semi-recumbent patient is left to hang near the trunk thus its weight helps reposition the humeral head anterior to the acromion. The C-arm is placed above the head of the table at 30° extending distally over the shoulder. This will allow an anteroposterior view of the humerus. The arm should be placed in reverse pushing position to clear the entry point, anatomically located at the superior margin of the articular surface just medial to the greater tuberosity.

Once the correct positioning and imaging are assured, the shoulder and arm are prepped and draped.

Surgical Technique
Instruments for opening the humerus

Entry Cuff Guard
Cat. No. 7175-1100

Disposable Cuff Guard
(Optional – may be used in place of 7175-1100 Entry Cuff Guard)
Cat. No. 7175-1101

3.2mm Tip Threaded Guide Pin
Cat. No. 7175-1147

Trocar
Cat. No. 7175-1136

Mini Connector with Handle
Cat. No. 7175-1137

Straight Entry Reamer
Cat. No. 7175-1103

Cannulated Awl
Cat. No. 7175-1102

Straight Ratcheting Driver
Cat. No. 7175-1141

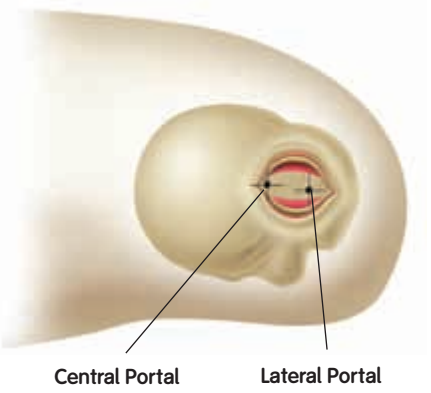
Surgical Technique
Incision

The incision approach that is recommended and most often used for antegrade humeral nailing is the lateral deltoid splitting incision. For complete fractures or nonunions, a traditional deltopectoral approach may be used.

A 2-3cm incision is made from the edge of the acromion to the edge of the head of humerus, anterolateral to the tip of the acromion. The deltoid is divided down to the sub-deltoid bursa. The deltoid muscle is then retracted. Visualize the rotator cuff insertion into the greater tuberosity. The biceps tendon is palpated anteriorly. The rotator cuff supraspinatus tendon is incised 15-20mm in line with its fibers, exposing the humeral head. Insert suture into the rotator cuff interval to retract the rotator cuff and facilitate its repair after insertion of the nail.

Lateral portal
Entry portal is made just medial to the tendon insertion and centered midway between the biceps groove anteriorly and the posterior humeral head.

Central portal (straight proximal nail)
Entry portal is made at the apex of the humeral head and centered midway between the biceps groove anteriorly and the posterior humeral head.



Surgical Technique
Entry Tool and Guide Pin placement

The rotator cuff is divided to expose the superior portion of the humeral head. The Entry Cuff Guard (7175-1100) protective device should be used to retract the soft tissue of the rotator cuff for visualization of the bone. The Cuff Guard provides a visual working channel, while protecting the rotator cuff and soft tissue during the procedure.

Attach the 3.2mm Tip Threaded Guide Pin (7175-1147) or Trocar (7175-1136) to the Mini Connector with Handle (7175-1133). Place through the Cuff Guard into the superior margin of the humeral head just medial to the greater tuberosity, avoiding the rotator cuff insertion.

Verify position on the C-arm to confirm guide pin placement is aligned in the medullary canal by oblique pictures at 45° with internal and external rotation of the shoulder.

Note The Disposable Cuff Guard (7175-1101) may be used to protect the rotator cuff while preparing the humerus for the nail. The Nail can be inserted through the Disposable Cuff Guard. A Drill Guide comes packaged with the Disposable Cuff Guard to facilitate the placement of the guide pin in the precise position.

Surgical Technique
Instruments fracture reduction and reaming

Straight Reducer
Cat. No. 7175-1105

Straight Ratcheting Driver
Cat. No. 7175-1141

2.0mm Graduated Ball Tip Guide Rod
Cat. No. 7175-1146

Obturator
Cat. No. 7175-1145

Ruler
Cat. No. 7175-1126

Fixed Endcutting Reamers (image not shown)
Cat. No. 7111-8220 to 7111-8230

Straight entry reamer
Cat. No. 7175-1103

Cannulated Awl
Cat. No. 7175-1102

Surgical Technique
Prepare proximal section

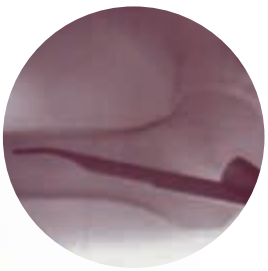
Insert the Straight Entry Reamer (7175-1103) over the 3.2mm Tip Threaded Guide Pin (7175-1147) or the Trocar (7175-1136) through the Entry Cuff Guard (7175-1100) and/or the Disposable Cuff Guard (7175-1101) to prepare the humerus for the proximal section of the nail. Ream until the cutting teeth are just below the articular surface of the humeral head. The depth indicator on the reamer should be level with the top of the Cuff Guard.

Alternatively, the Cannulated Awl (7175-1102) can be used with the Straight Ratcheting Driver (7175-1141).

Surgical Technique
Fracture reduction

After removing the Straight Entry Reamer (7175-1103) and 3.2mm Tip Threaded Guide Pin (7175-1147) or Trocar (7175-1136), insert the Straight Reducer (7175-1105) attached to the Straight Ratcheting Driver (7175-1141) with the slot oriented toward the lateral cortex and reduce the fracture. Place the tip of the finger off the medial cortex to help reduce the fracture.

To maintain reduction, introduce the 2.0mm Graduated Ball Tip Guide Rod (7175-1146) through the Straight Reducer. Center the Guide Rod 1-2cm proximal to the olecranon fossa in the distal end of the humerus. Once the Guide Rod is in place, carefully remove the Straight Reducer, using the Obturator (7175-1145) as needed to ensure the Guide Rod stays in place.



Surgical Technique
Measuring implant length

To measure the length of the implant needed, ensure that the distal tip of the 2.0mm Graduated Ball Tip Guide Rod (7175-1146) is located at the desired position of the distal tip of the nail. Slide the Ruler (7175-1126) over the proximal end of the 2.0mm Graduated Ball Tip Guide Rod and advance the open end of the Ruler to where the proximal portion of the implant will be seated, just below the articular surface of the proximal humerus. Read the nail length from the calibrations exposed at the other end of the Ruler.

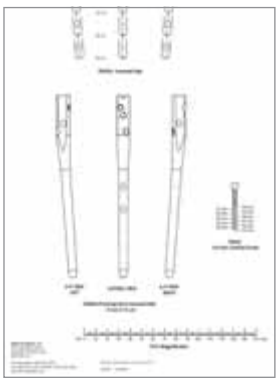
The 2.0mm Graduated Ball Tip Guide Rod has graduated markings and can be used to determine required implant length. The Straight Reducer (7175-1105) can also be used to determine implant length, by using the markings on the reducer shaft. Both options are used to directly measure to the articular surface, taking care to ensure the nail will be slightly countersunk.

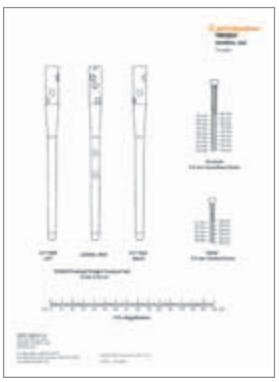
Additional limited reaming

(Necessary for Proximal Nails longer than 8mm X 16cm)

After the nail length has been determined, additional limited reaming can be performed to avoid nail incarceration and distraction at the fracture site during insertion of the nail. Begin with the 6.0mm Fixed Endcutting Reamer (7111-8220 to 7111-8230) and insert it over the 2.0mm Graduated Ball Tip Guide Rod. Ream the intramedullary canal sequentially. Be careful not to “push” the guide rod distally during reaming. Never insert a nail that has a larger diameter than the last reamer used.

It is recommended that templating is done for all cases to estimate the size of the implant needed. The diameter of the last reamer used will help determine the diameter of the implant needed. Keep in mind that all of the nail sizes taper, and the canal should be reamed to 1mm over the implant diameter.





Surgical Technique
Instruments for nail assembly and insertion

Humeral Nail Guide Bolt
Cat. No. 7175-1108

Nail Drill Guide
Cat. No. 7175-1129

Guide Bolt Wrench
Cat. No. 7175-1134

Impactor
Cat. No. 7175-1133

Proximal Drop
Cat. No. 7175-1131

Gold Outer Sleeve
Cat. No. 7175-1128

3.2mm Silver Inner Drill Sleeve
Cat. No. 7175-1116

3.2mm Long Graduated Two-Flute Drill
Cat. No. 7175-1149

Anterior Stylus
Cat. No. 7175-1130

Trocar
Cat. No. 7175-1136

Humeral Nail Drill Guide Probe
Cat. No. 7169-1152

Surgical Technique
Nail Drill Guide assembly

Once the implant selection is complete, use the Humeral Nail Guide Bolt (7175-1108) to attach the Nail Drill Guide (7175-1129) to the nail. The nail and Nail Drill Guide are keyed to ensure proper orientation of the nail on the Nail Drill Guide.

Note The metal threads on the proximal locking holes should always be lateral. Tighten the Humeral Nail Guide Bolt using the Guide Bolt Wrench (7175-1134). The Impactor (7175-1133) is then attached to the Humeral Nail Guide Bolt.

To complete the assembly, attach the Proximal Drop (7175-1131) to the lateral arm of the Nail Drill Guide. Tighten the Proximal Drop to the Guide using the knurled knob. Verify targeting accuracy by inserting a Gold Outer Sleeve (7175-1128) and 3.2mm Silver Inner Drill Sleeve (7175-1116) into the drop and passing a 3.2mm Long Graduated Two-Flute Drill (7175-1149) through the assembly. An incorrectly attached nail will not target. The Proximal Drop should be used to target the proximal screws on all Humeral Nails, and the distal screws on the 16cm Proximal Nails. Distal locking screws for the 18cm or longer Humeral Nails should be targeted using the TRIGEN® SURESHOT® Distal Targeting System or a freehand technique.

Refer to SURESHOT User Manual for the Field Accuracy check instructions.

Check with the TRIGEN SURESHOT Distal Targeting System.

The Humeral Nail and Nail Drill Guide are keyed to ensure proper orientation of the nail on the Nail Drill Guide.

Surgical Technique
Nail insertion

At this point the nail is ready to be inserted. Care should be taken to insert the nail with the correct amount of retroversion and depth in order to maximize locking screw fixation while avoiding critical soft tissues such as the biceps tendon, axillary and radial nerves.

Insert the nail attached to the Nail Drill Guide Assembly over the 2.0mm Graduated Ball Tip Guide Rod (7175-1146) and through the Entry Cuff Guard (7175-1100) with the lateral arm of the drill guide oriented with approximately 30-35° of retroversion. Adjustments to this version can be made so that the anterior arm of the drill guide is in line with the lesser tuberosity, avoiding alignment with the bicipital groove. Proper depth is achieved when the lateral ledge on the drill guide is above the lateral cortex and the nail is seated just below the articular surface.

Remove the Guide Rod from the top of the Nail Drill Guide (7175-1129). Confirm that the fracture is compacted and not distracted.

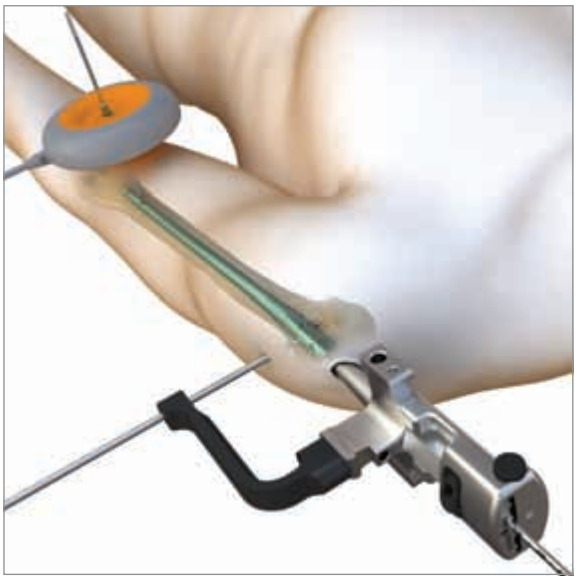
Surgical Technique
Final version adjustment

Final and rigid version adjustment to the nail can be performed prior to inserting the proximal locking screws by attaching the Anterior Stylus (7175-1130) to the anterior arm of the Nail Drill Guide (7175-1129).

Insert the Trocar (7175-1136) through the Anterior Stylus and position the nail so that the Trocar can be inserted into the lesser tuberosity at the location of the anterior locking hole. Leave the Trocar in place to maintain fracture reduction and rotational stability during the insertion of the proximal lateral screws.

This step ensures that the proximal anterior and proximal anterolateral locking screws will not be inserted into the bicipital groove, potentially injuring the biceps tendon (Figure 16b).

Note When using the TRIGEN® SURESHOT® Distal Targeting System, move the Anterior Stylus (7175-1130) to the lateral side of the Proximal Drop (7175-1131) after the final version is determined and insert a 3.2mm Tip Threaded Guide Pin (7175-1147) to provisionally secure the nail.



Surgical procedure –
TRIGEN® SURESHOT® system set up

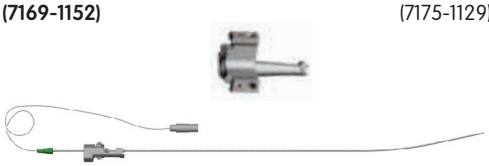
Probe assembly

Insert the SURESHOT Humeral Drill Guide Probe (7169-1152) with the assembled SURESHOT Humeral Set Stop (7169-1151) through the Nail Drill Guide (7175-1129) and cannulation of the TRIGEN IM nail.

Tip The back of a standard AO MiniConnector (7175-1153) may be used as a lever to release the set stop from the drill guide if overtightened.

TRIGEN SURESHOT Humeral Nail Drill Guide Probe (7169-1152)

Dark Green probe
Use only with Humeral Drill Guide (7175-1129)



Set the probe to the length of the TRIGEN IM Nail.

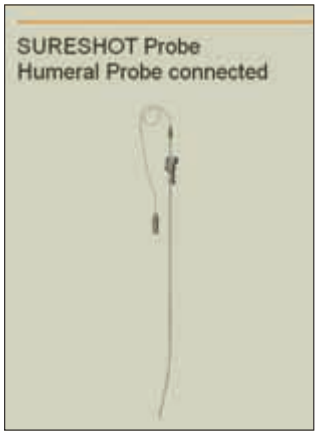
Note Verify the probe is oriented correctly in the set stop (notches should face laterally). If the probe is rotated 180°, it will not be accurate.

For Humeral, notches should face laterally

Note The probe is bent for easier insertion. Do not straighten it as this may cause inaccuracy or even missing the lock.

Probe connection

Connect the probe to either of the probe sensor ports on the Trauma Interface.



Confirm that the tool connection has been verified.

Note When oriented as shown, the connector should assemble easily. Do not force the connector into the port. Simply try rotating the connector until the keys are oriented in the 12 o'clock position.

Note If the probe is properly connected to the system and the application reports "Probe not found" for more than 10 seconds, the probe may be damaged or defective. In this case, the probe has to be exchanged.

Note It is possible at any time to disconnect and reconnect tools when the application is running. The display will show a screen reporting the missing instrument.

Surgical procedure –
TRIGEN® SURESHOT® system set up

Drill sleeve selection

Select the 3.2mm humeral drill sleeve (7169-1154).

Implant selection screen

Select the TRIGEN IM Nail and size that will be used.

Humeral Nail

Note A different TRIGEN IM Nail and/or size can be selected at any time during the procedure by choosing the Implant option from the drop down menu OR by pressing the implant tab located in the lower left corner of the navigation screen.

Surgical procedure – after IM Nail Assembly to the Drill Guide

Drill sleeve attachment

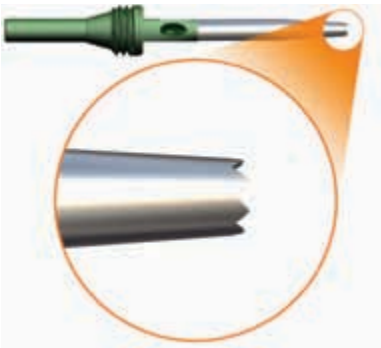
Tightly secure the selected drill sleeve to the Targeter.

Note The Humeral Drill Sleeve (7169-1154) can be loosened from the targeter using the slot in the TRIGEN® Slotted Hammer (7175-1135).

Surgical Technique
Skin incision with TRIGEN◇ SURESHOT◇

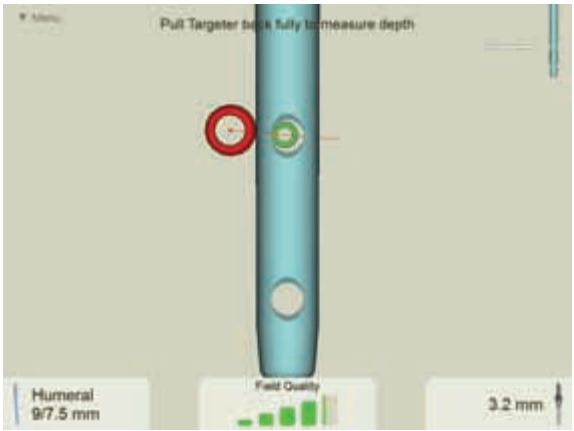
Skin incision

Use the serrated tip of the SURESHOT Humeral 3.2mm Drill Sleeve (7169-1154) to identify where to make the incision. The tip is at the right position when the green circle is aligned with the desired hole on screen.



Make the incision and place the tip of the drill sleeve down to bone where the green circle is aligned directly over the hole on the screen.

Note No X-Rays are necessary.

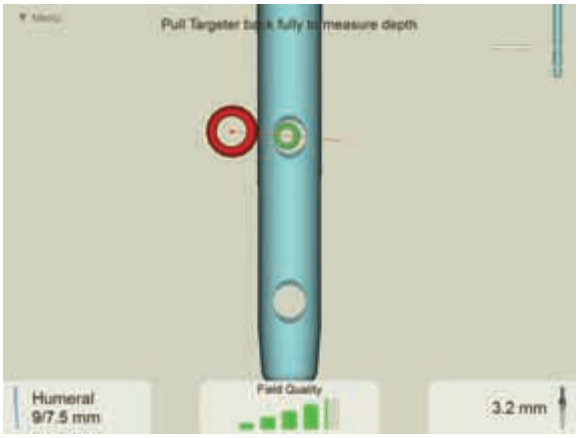


Surgical Technique
Targeting the locking hole

With the TRIGEN® SURESHOT® Humeral 3.2mm AO Drill (7169-1155) inserted into the TRIGEN SURESHOT Targeter (7169-2801), insert the tip of the SURESHOT Humeral 3.2mm Drill Sleeve (7169-1154) (represented by the green circle) through the incision and down to bone.

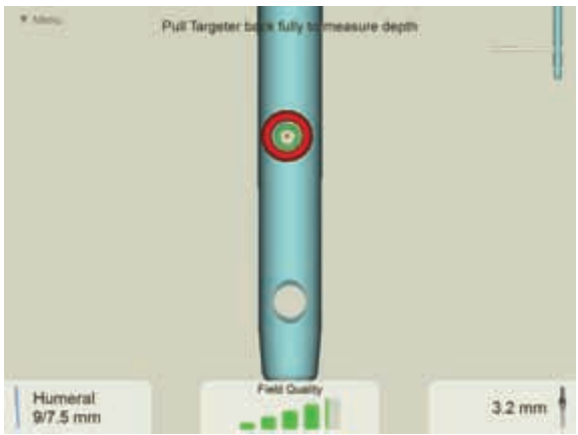
Critical Verify there are no other metal objects (including metal triangles) in the field. Metal interference will cause the system to be inaccurate.

Tibia shown in image



Perfect circles
Align the tip of the drill sleeve over the desired hole in the nail. This will be represented on the screen when the green circle is centered in the hole as shown. Push the serrated tip firmly against bone to keep the green circle static on the screen.

Adjust the trajectory (represented by red line between two circles) of the red circle until both circles are concentric and centered with the desired hole on the screen. Then start drilling.



Note The green circle must be fully within the hole of the IM nail displayed on the Trauma Interface screen to ensure accurate drilling.

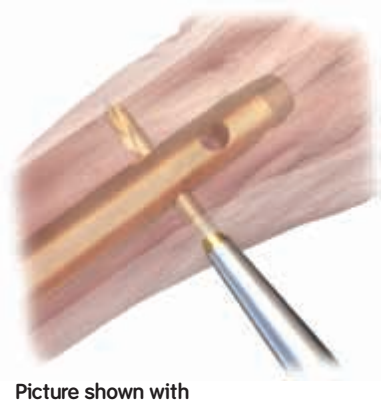
Surgical Technique
Drilling distal hole

Drill through near cortex and the nail using the TRIGEN® SURESHOT® Humeral 3.2mm AO Drill (7169-1155). Before drilling through far cortex, obtain the screw measurement.

Note Important: if standard 3.2mm Graduated Two-Flute Drill is used, magnetic metal can adversely affect accuracy causing the drill to miss. Verify there is no other magnetic metal object in area other than the items shown.

A note will appear on screen warning of compromised targeting field, if magnetic metal is close. If it is in the field, image disappears.

Drill Depth Measurement
Refer to User Manual Page 16 and 17 for drill depth measurements.



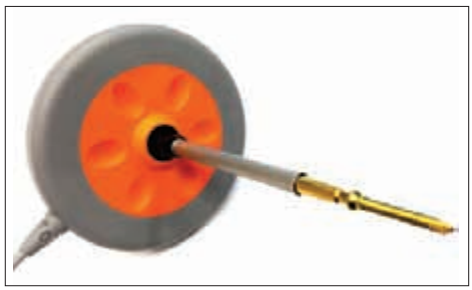
Picture shown with TRIGEN META-NAIL®

Surgical Technique

Screw insertion

Using the TRIGEN® SURESHOT® Hexdriver (7169-1153), the screw may be inserted using the Targeter.

WARNING The standard TRIGEN Hexdrivers are made from magnetic stainless steel that will cause interference with the system and cannot be used.



Surgical Technique

Instruments for proximal locking, distal locking of Proximal 16cm Humeral Nails and freehand distal locking

Proximal Drop
Cat. No. 7175-1131

Nail Drill Guide
Cat. No. 7175-1129

3.2mm Silver Inner Drill Sleeve
Cat. No. 7175-1116

Gold Outer Sleeve
Cat. No. 7175-1128

Trocar
Cat. No. 7175-1136

3.2mm Long Graduated Two-Flute Drill
Cat. No. 7175-1149

Screw Depth Gauge
Cat. No. 7175-1139

3.5mm Hex Driver
Cat. No. 7175-1140

Straight Ratcheting Driver
Cat. No. 7175-1141

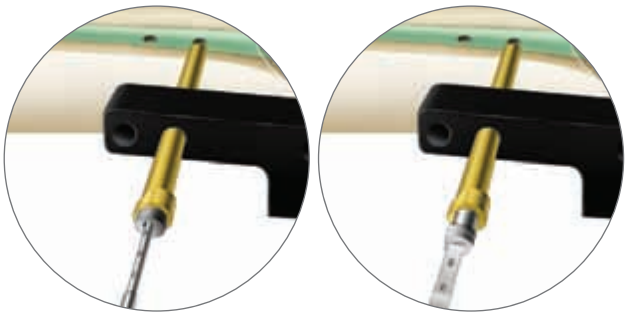
Screw Length Sleeve
Cat. No. 11-0238

Surgical Technique
Distal locking screws for TRIGEN® Proximal 16cm Humeral Nails

Note The Proximal Drop (7175-1131) only targets the distal holes for the 16cm nails. Nails longer than 16cm will be targeted using the freehand technique or TRIGEN SURESHOT® Distal Targeting System.

With the Proximal Drop connected to the lateral arm of the Nail Drill Guide (7175-1129), place the 3.2mm Silver Inner Drill Sleeve (7175-1116) into the Gold Outer Sleeve (7175-1128). Insert the sleeve unit into the targeting hole in the Proximal Drop which corresponds to the superior M/L distal locking hole in the nail. While applying compression at the condyles of the elbow to reduce shaft fractures as needed, make a stab incision and push the sleeve unit down to the bone. The Trocar (7175-1136), in combination with the drill sleeve unit, may be used to dimple the cortex. Drill through both cortices using the 3.2mm Long Graduated Two-Flute Drill (7175-1149). A length measurement can be taken from the calibrations on the drill against the 3.2mm Silver Inner Drill Sleeve, or the Screw Depth Gauge (7175-1139) can be used through the Gold Outer Sleeve to measure for distal locking screws.

Once the appropriate length 4.0mm Self-Tapping Cortical Screw is selected, it is attached to the 3.5mm Hex Driver. The screw is inserted through the Gold Outer Sleeve using the 3.5mm Hex Driver (7175-1140). The head of the screw should be nearly seated when the laser-marked ring on the Hex Driver is even with the Gold Outer Sleeve. Final tightening of the screw should always be performed manually using the Straight Ratcheting Driver (7175-1141). Repeat this process for the inferior distal screw.



Surgical Technique
Proximal locking screws

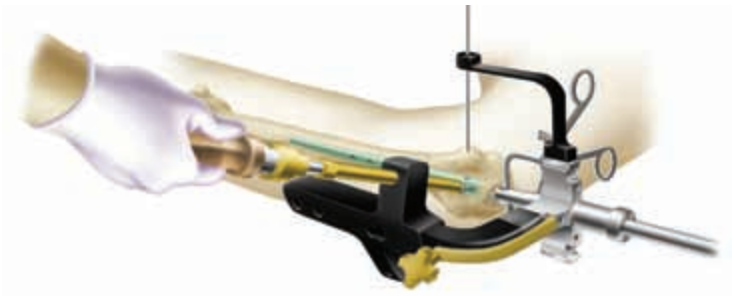
Caution Do not countersink the nail such that proximal locking screws are below the level of the humeral head to avoid damage to the axillary nerve.

In order to avoid impingement of the biceps tendon, it is a good idea to start with the proximal anterolateral locking screw. Place the 3.2mm Silver Inner Drill Sleeve (7175-1116) into the Gold Outer Sleeve (7175-1128). Insert the sleeve unit into the Proximal Drop (7175-1131). The Trocar (7175-1136) can be inserted into the sleeve unit to determine the exact location for the insertion of the locking screw. If the Trocar tip indicates the proximal anterolateral screw is in line with the bicipital groove, reorient the nail to avoid impingement. Once proper alignment has been achieved, make a stab incision and push the sleeve unit down to the bone. Use the Trocar to dimple the cortex. Remove the Trocar from the sleeve unit and drill through the near cortex, stopping at the articular surface of the far cortex using the 3.2mm Graduated Two-Flute Drill (7175-1149). Take the length measurement from the calibrations on the drill or the Screw Depth Gauge (7175-1139). The 3.2mm Silver Inner Drill Sleeve must be removed from the Gold Outer Sleeve in order to use the Screw Depth Gauge.

Surgical Technique
Proximal locking screws

Remove the 3.2mm Silver Inner Drill Sleeve (7175-1116) and insert the 3.5mm Hex Driver (7175-1140) with the appropriate length 5.0mm Cancellous Screw attached. The head of the screw should be nearly seated when the laser marked ring on the 3.5mm Hex Driver is even with the Gold Outer Sleeve (7175-1128). Final seating of the screw should always be under manual control using the Straight Ratcheting Driver (7175-1141) to avoid over insertion of the screw in soft bone.

Insert the remaining two proximal locking screws.



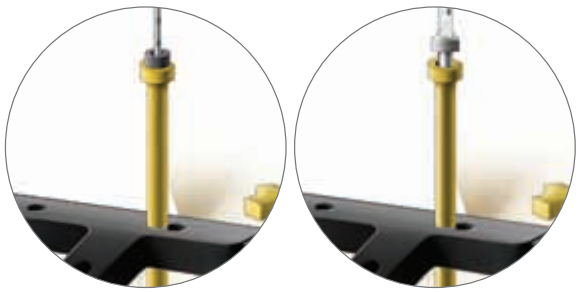
Surgical Technique
Proximal locking screws

To target the proximal anterior locking hole, remove the Anterior Stylus (7175-1130) and attach the Proximal Drop (7175-1131) on the anterior arm of the Nail Drill Guide (7175-1129).

Caution Locate biceps tendon prior to beginning placement of the anterior screw.

Insert the 3.2mm Silver Inner Drill Sleeve (7175-1116) into the Gold Outer Sleeve (7175-1128). Insert the sleeve unit into the hole marked “Anterior” on the Proximal Drop.

Follow the same procedure described previously to drill, measure and insert the Anterior and Posterior Proximal Screws.



Surgical Technique
Distal locking screws without the use of TRIGEN◇ SURESHOT◇

Freehand locking
Distal locks on all nails 18cm and longer should be done using the freehand technique. The Screw Length Sleeve (11-0238) can be used with the 3.2mm Graduated Two-Flute Drill (7175-1149) to drill for the A/P distal locks. Length measurements can be made by using the graduations on the drill against the Screw Length Sleeve. The Screw Depth Gauge (7175-1139) could also be used to determine the appropriate screw length. Once the appropriate length 4.0mm Self-Tapping Cortical Screw is selected, it is attached to the 3.5mm Hex Driver (7175-1140). The screw is inserted through the Gold Outer Sleeve (7175-1128) using the 3.5mm Hex Driver. Final tightening of the screw should always be performed manually using the Straight Ratcheting Driver (7175-1141). Repeat this process for the inferior distal screw.

Surgical Technique
Closure

Close the wound in layers, use nonresorbable sutures in the rotator cuff repair. Close the remainder of the incision in a standard fashion.

Removal of the nail
The Screw Head Trephine (7175-1144), the Proximal Nail Trephine (7175-1143) and the Extractor (7175-1142) are included in the instrument set to facilitate nail removal.

Catalog information
TRIGEN® Humeral Nail Implants

TRIGEN Humeral Nail Implant Set
Set No. 7175-0703

TRIGEN Humeral Nail Cap
(Not Shown)
Cat. No. 7176-0000

TRIGEN Proximal Straight Humeral Nail

Cat. No.	Size	Length
7176-0816	8/7mm	16cm

TRIGEN Proximal Bent Humeral Nail

Cat. No.	Size	Length
7177-0816	8/7mm	16cm

TRIGEN Long Bent Humeral Nail

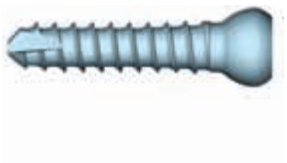
Cat. No.	Size	Length
7177-0818	8/7mm	18cm
7177-0820	8/7mm	20cm
7177-0822	8/7mm	22cm
7177-0824	8/7mm	24cm
7177-0826	8/7mm	26cm
7177-0828	8/7mm	28cm
7177-0918	9/7.5mm	18cm
7177-0920	9/7.5mm	20cm
7177-0922	9/7.5mm	22cm

Cat. No.	Size	Length
7177-0924	9/7.5mm	24cm
7177-0926	9/7.5mm	26cm
7177-0928	9/7.5mm	28cm
7177-1018	10/8.5mm	18cm
7177-1020	10/8.5mm	20cm
7177-1022	10/8.5mm	22cm
7177-1024	10/8.5mm	24cm
7177-1026	10/8.5mm	26cm
7177-1028	10/8.5mm	28cm

5.0mm Self-Tapping Cancellous Screw

Cat. No.	Length
7175-5024	24mm
7175-5026	26mm
7175-5028	28mm
7175-5030	30mm
7175-5032	32mm
7175-5034	34mm
7175-5036	36mm
7175-5038	38mm
7175-5040	40mm
7175-5042	42mm
7175-5044	44mm

Cat. No.	Length
7175-5046	46mm
7175-5048	48mm
7175-5050	50mm
7175-5052	52mm
7175-5054	54mm
7175-5056	56mm
7175-5058	58mm
7175-5060	60mm
7175-5062	62mm
7175-5064	64mm



4.0mm Self-Tapping Cortical Screw

Cat. No.	Length
7175-4020	20mm
7175-4022	22mm
7175-4024	24mm
7175-4026	26mm
7175-4028	28mm
7175-4030	30mm

Cat. No.	Length
7175-4032	32mm
7175-4034	34mm
7175-4036	36mm
7175-4038	38mm
7175-4040	40mm

Catalog information
TRIGEN® Humeral Nail Instruments

TRIGEN Humeral Nail Instrument Set
Set No. 7175-1150

Entry Cuff Guard
Cat. No. 7175-1100

Disposable Cuff Guard
Cat. No. 7175-1101

3.2mm Tip Threaded Guide Pin
Cat. No. 7175-1147

Trocar
Cat. No. 7175-1136

Mini Connector with Handle
Cat. No. 7175-1137

Straight Entry Reamer
Cat. No. 7175-1103

Small Hammer
Cat. No. 7175-1135

Humeral Nail Guide Bolt
Cat. No. 7175-1108

Nail Drill Guide
Cat. No. 7175-1129

Guide Bolt Wrench
Cat. No. 7175-1134

Catalog information
TRIGEN® Humeral Nail Instruments

Impactor
Cat. No. 7175-1133

Straight Reducer
Cat. No. 7175-1105

Straight Ratcheting Driver
Cat. No. 7175-1141

*2.0mm x 600mm Graduated 3.2mm Ball Tip Guide Rod
Cat. No. 7175-1146

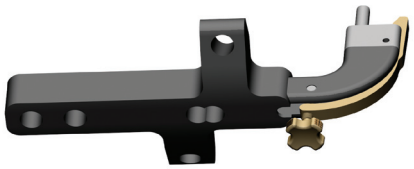
Obturator
Cat. No. 7175-1145

Ruler
Cat. No. 7175-1126

image not shown

Fixed Endcutting Reamers

Size	Cat. No.
6.0mm	7111-8220
7.0mm	7111-8222
8.0mm	7111-8224
9.0mm	7111-8226
10.0mm	7111-8228
11.0mm	7111-8230



Proximal Drop
Cat. No. 7175-1131

Anterior Stylus
Cat. No. 7175-1130

3.2mm Silver Inner Drill Sleeve
Cat. No. 7175-1116

*Dedicated to Humeral nail only, cannot be used with other TRIGEN systems (HFN)

Catalog information
TRIGEN® Humeral Nail Instruments

Gold Outer Sleeve
Cat. No. 7175-1128

3.2mm Graduated Two-Flute Drill

Description	Cat. No.
Short	7175-1148
Long	7175-1149

Screw Depth Gauge
Cat. No. 7175-1139

3.5mm Hex Driver
Cat. No. 7175-1140

AO Mini Connector
Cat. No. 7175-1153

Mini Connector
Cat. No. 7163-1186

Trinkle Connector
Cat. No. 7163-1187

Screw Head Trephine
Cat. No. 7175-1144

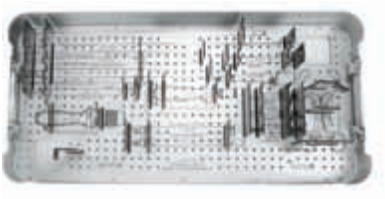
Proximal Nail Trephine
Cat. No. 7175-1143

Extractor
Cat. No. 7175-1142

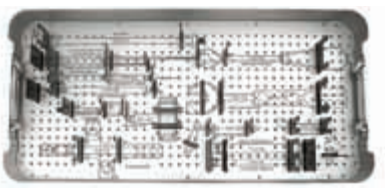
Cannulated Awl
Cat. No. 7175-1102

Catalog information
TRIGEN® Humeral Nail Instruments

Screw Length Sleeve
Cat. No. 11-0238



Top Instrument Tray
Cat. No. 7175-1151



Bottom Instrument Tray
Cat. No. 7175-1152

Case
Cat. No. 7112-9400

Case Lid
Cat. No. 7112-9402

Reamer Cassette
Cat. No. 7175-1156

Catalog information
TRIGEN® SURESHOT® Instruments

TRIGEN SURESHOT Targeting Interface
Cat. No. 7165-7000

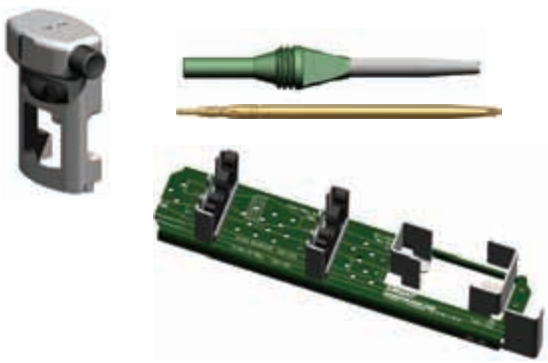
Cat. No.	Device	Case Qty
7169-2802	Trauma Interface	1

TRIGEN SURESHOT Targeting Instrument Set
Set No. 7165-7001

Cat. No.	Description	Tray Qty
7169-2801	Targeter	1
7169-2804	Drill Sleeve - Long	2
7169-2805	Drill Sleeve - Short	2
7169-2806	META Set Stop	1
7169-2807	TAN® Set Stop	1
7169-2808	Field Accuracy Gauge	1
7169-2809	Hexdriver	1
7169-2816	TAN Anteversion Locking Guide	1
7169-2830	Targeting Instrument Tray	1
7169-2831	Targeting Instrument Tray Lid	1

TRIGEN SURESHOT Humeral Instrument Set
Set No. 7165-1100

Cat. No.	Description	Qty
7169-1151	SURESHOT Humeral Set Stop	1
7169-1153	SURESHOT Humeral 3.5mm Hexdriver	1
7169-1154	SURESHOT Humeral 3.2mm Drill Sleeve	2
7169-1156	SURESHOT Humeral Instrument Caddy	1



TRIGEN SURESHOT Humeral Disposable Set
Set No. 7165-1101

Cat. No.	Description	Qty
7169-1152	SURESHOT Humeral Drill Guide Probe	2
7169-1155	SURESHOT Humeral 3.2mm AO Drill	2

Catalog information
TRIGEN® SURESHOT® Instruments

TRIGEN SURESHOT Country Kit – North America
Cat. No. 7165-7003

Cat. No.	Description	Qty
6680-0193	Power Cord, 125 Volt 10 Amp – North America (Hospital Grade)	1
7118-1927	User Manual, English	1

Additional Country Kits

TRIGEN SURESHOT Country Kit – Australia
Cat. No. 7165-7004

Cat. No.	Description	Qty
6680-0303	Power Cord, 250 Volt 10 Amp – Australia/NZ	1
7118-1927	User Manual, English	1

TRIGEN SURESHOT Country Kit – Continental Europe
Cat. No. 7165-7005

Cat. No.	Description	Qty
6680-0291	Power Cord, 250 Volt 10 Amp – Continental Europe	1
7118-1927	User Manual, English	1

TRIGEN SURESHOT Country Kit – Germany
Cat. No. 7165-7006

Cat. No.	Description	Qty
6680-0291	Power Cord, 250 Volt 10 Amp – Continental Europe	1
7118-1538	User Manual, German	1

TRIGEN SURESHOT Country Kit – Spain
Cat. No. 7165-7007

Cat. No.	Description	Qty
6680-0291	Power Cord, 250 Volt 10 Amp – Continental Europe	1
7118-1539	User Manual, Spanish	1

TRIGEN SURESHOT Country Kit – Italy
Cat. No. 7165-7009

Cat. No.	Description	Qty
6680-0291	Power Cord, 250 Volt 10 Amp – Continental Europe	1
7118-1536	User Manual, Italian	1

TRIGEN SURESHOT Country Kit – United Kingdom
Cat. No. 7165-7011

Cat. No.	Description	Qty
6680-0213	Power Cord, 250 Volt 10 Amp – UK	1
7118-1927	User Manual, English	1

TRIGEN SURESHOT Country Kit – South Africa/India
Cat. No. 7165-7012

Cat. No.	Description	Qty
6680-0302	Power Cord, 250 Volt 10 Amp – So. Africa/India	1
7118-1927	User Manual, English	1

Smith & Nephew, Inc.
7135 Goodlett Farms Parkway
Cordova, TN 38016
USA

www.smith-nephew.com

Telephone: 1-901-396-2121
Information: 1-800-821-5700
Orders and Inquiries: 1-800-238-7538

® Trademark of Smith & Nephew. Certain marks Reg. US Pat. & TM Off.

© 2014 Smith & Nephew, Inc. All rights reserved.
01363 V1 71181802 REVB 01/14